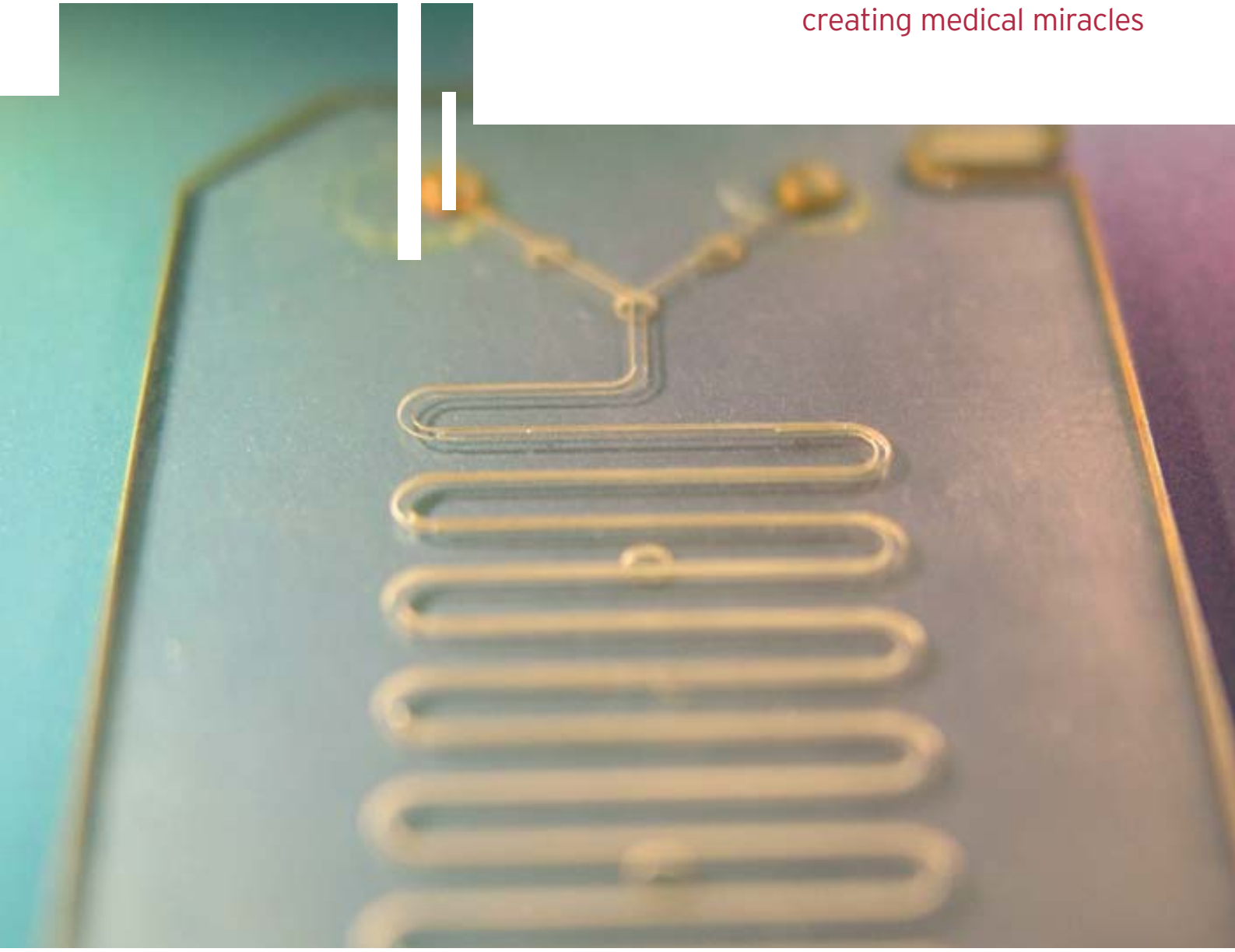
Australian Nanotechnology
Nano-biotechnology

creating medical miracles



THE FUTURE IS here

Nanotechnology Australia

Australian Government
Invest Australia

Image courtesy of the CRC for Polymers

a **strategic** destination for **nanotechnology** industry **investment**

World-leading nanoscale biotechnology research, coupled with government support and outstanding infrastructure, provide untapped opportunities for investors in Australian nano-biotechnology.

the **australian advantage**

Strong support for nanotechnology research at all levels of government

Advanced research activities across a wide range of biotech-related nanotechnologies

Immediate commercialisation opportunities in drug delivery, biosensing, implants and biomaterials

Strong linkages between Australian nanotechnology researchers and companies and international institutions

Australia's fast growing and dynamic nanotechnology sector has strong skills in the development and commercialisation of nanoscale biotechnologies ('nanobio').

Activity includes world leading research into carbohydrate and protein chemistry for the development of new therapeutic treatments, advanced drug delivery systems using nano-scale particles, and the creation of biocompatible nano-engineered polymers for implants. Work in nano-scale bio-sensing is moving rapidly toward commercial outcomes.

Australia has a history of world-wide successes in the biological and molecular sciences, and is ideally suited to gaining a strong position in nanobio applications. Australia has a well deserved reputation for clinical research and the development and discovery of therapeutic agents.
To complement this, the Australian biotechnology industry has also developed a strong level of capability in the discovery of novel methods of drug design and delivery. This capability is highlighted by the number of major partnerships and collaborative agreements that the Australian drug delivery sector has been able to establish, both domestically and overseas.

Image courtesy of MiniFAB

nanotechnology in australia

The Australian Government is committed to developing a globally-focused nanotechnology capability, and is providing extensive support to both the research community and industry.

Up to A$100 million is provided each year by Australian, State and Territory governments and private entities for research and commercialisation of nanotechnology. The Australian Government's new *Backing Australia's Ability – Building our Future through Science and Innovation* package invests an additional A$5.3 billion into science and innovation, bringing total funding under *Backing Australia's Ability* to A$8.3 billion over ten years from 2001.

There are some 70 research groups around Australia working on nanotechnology, including universities, government research institutions such as the Commonwealth Scientific and Industrial Research Organisation (CSIRO), the Australian Nuclear Science Technology Organisation (ANSTO) and the Defence Science Technology Organisation (DSTO), and joint government and industry funded Cooperative Research Centres. The Australian Research Council (ARC) is currently funding more than 200 nanotechnology-related projects, with a total of 322 projects receiving A$122 million since 1998.

Australia continues to build its base of world-renowned nanotechnologists, predominantly through the ARC Federation Fellowship program, which has provided over A$20 million for experts working in the field.

At the State level, the Queensland Government is establishing the A$60 million Australian Institute for Bioengineering and Nanotechnology (AIBN) at the University of Queensland. Another State-based initiative, Nanotechnology Victoria (NanoVic), brings together nanotechnology from universities in Melbourne (Monash, Swinburne, and RMIT) and the Australian peak research organisation, the CSIRO, to drive commercial outcomes from Victoria's strong nanotechnology capability. The consortium was established with total funding of A$28 million, with the Victorian Government providing A$12 million.

There are over 50 nano-focused Australian companies commercialising Australia's research output.

demonstrated suc

advanced drug delivery

The ability to nano-engineer particles for the precise delivery of drugs and other therapies is a strong focus for many Australian nanobio companies and research institutions.

The NASDAQ-listed Australian company, pSivida Ltd is using novel silicon structures for controlled release drug delivery. The honeycomb matrix of pSivida's BioSilicon can be used to hold numerous drug treatments, and degrades slowly into silicic acid, commonly found in many foods. Potential applications include diagnostics, cancer therapies, orthopaedics and tissue engineering.

Elimination of liver cancer is the goal of Sirtex Medical Ltd. Its SIR-Sphere® technology encapsulates a range of nanomolecules, such as biocompatible radioactive compounds and cancer treatments, for targeted release in liver tumours. Sirtex's technology can find and irradiate cancer cells using Selective Internal Radiation Therapy (SIRT), to deliver anti-cancer drugs or hyperthermic treatments. SIR-Spheres® have already been approved for use in many parts of the world, including the US, European Union, India, Hong Kong and a number of South East Asian countries.

CeramiSphere is working with nano-engineered ceramics for encapsulation of a range of biomolecules with potential use in drug delivery. Based on research undertaken at ANSTO, CeramiSphere's technology allows for variable release rates, and as encapsulation takes place at ambient temperatures, damage to the biomolecules is minimised.

ccess

new research

Australia is taking a leading role in the development of many new fields of nano-biotechnology.

The Nanotechnology and Biomaterials Centre is a cross-faculty research centre at the University of Queensland that focuses on creating novel materials and devices for medical and diagnostic needs. Examples of these include devices for rapid DNA sequencing (using colloidal particles and its unique 'bar code'), genetic screening, drug delivery and drug discovery. Commercial applications are being taken forward by the spin-off company Nanomic BioSystems Pty Ltd.

Proteome Systems Pty Ltd is recognised as a global leader in the area of protein science, or proteomics, manufacturing novel diagnostics and prognostics technologies for medicine and agri-biotechnology applications. Proteome Systems has commercialised a comprehensive system for high throughput proteomics, called ProteomIQ™, which is being marketed in collaboration with IBM in the US. It has also developed a platform technology in collaboration with Japanese company Shimadzu Biotech. The Chemical Inkjet Printer (ChIP) is a proprietary platform technology for proteome analysis and characterisation using nanofluidics. ChIP dispenses pico- and nano-litre volumes to microprint and characterise information onto a spot on a protein, leaving the rest of the sample protein available to study later. The company was awarded the Frost & Sullivan 'Technology Innovation Award in the Proteomics Automation Market' in 2003.

Another area of world leading research is in large synthetic molecules called Dendrimers. Measuring between one and 50 nanometres in width, these molecules can be produced to precise specifications for holding numerous drug treatment molecules. Starpharma has discovered and is developing dendrimers for a range of diseases, including cancer, diabetes and respiratory viruses. In 2003, its HIV prevention microcibe, VivaGel™ became the world's first dendrimer-based drug to be approved for human trials by the US Food and Drug Administration (FDA).

Alchemia Pty Ltd, a publicly listed Australian company, has commercialised its VAST technology, a nanoscale drug discovery technique for systematically scanning 'molecular diversity space'. Alchemia uses VAST to identify candidates for therapeutic indications, the most advanced being an anti-cancer treatment for which the company hopes to finalise pre-clinical studies this year. Alchemia has also developed technology for molecular manufacturing and is running a commercial program to manufacture a synthetic form of heparin in alliance with Dow Chemical, and American Pharmaceutical Partners.

bio sensing

Using nanotechnologies to sense chemical and biological substances is a key strength of Australian research, with programs currently underway at South Australia's Flinders University and the University of Technology, Sydney.

The CRC for Microtechnology's spin-off company BioSenZ Pty Ltd has developed BioSaw, a sensor technology for the detection of bio-products (to the parts-per-billion level) uses novel patented Surface Acoustic Wave technology. BioSaw has applications in veterinary, human health, the environment and biohazards, and is now being customised to sense Legionella bacteria.

Private company AMBRI Pty Ltd's bio sensing technology uses patented Ion Channel Switch™ (ICS) technology for detecting chemical and biological substances in body fluid, food and water. ICS is a nanoscale platform that forms a self-assembling bio-membrane, and forms the basis of the first ever purpose-built nanomachine operating with moving parts that are nanometres in dimension.

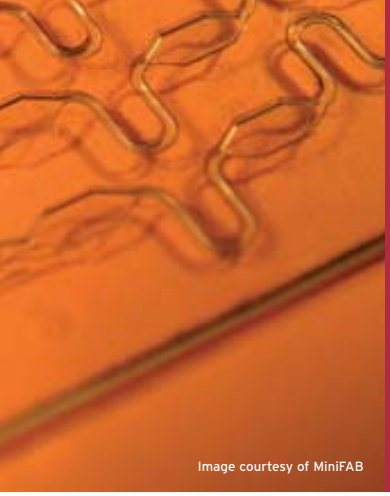


Image courtesy of MiniFAB

ICS has application on-site, for fast detection of bacteriological contamination, with potential use by the military, veterinary diagnostics, food testing to quickly identify dangerous organisms such as salmonella and enterococcus, and environmental monitoring, such as measuring faecal coliform bacteria in water. AMBRI is commercialising ICS in conjunction with US company Biosensor Enterprises LLC, a joint venture between Dow Corning Corporation and Genecor International.

hearing impairment

Cochlear Ltd's bionic ear implant technology electronically stimulates the auditory nerve to provide safe, reliable and effective treatment for moderate to profound sensorineural hearing loss.

Surgical use of the implant in Australia commenced in 1982, and it was the first implant of its kind to gain FDA approval for use. The key to the technology is the nanoscale bio-material interface—a silicone elastomer—between the metal electrode implanted in the cochlea and the nerve endings they stimulate.

The University of Wollongong, Intelligent Polymer Research Institute (IPRI) is a collaborative partner with the Cooperative Research Centre for Cochlear Implant and Hearing Aid Innovation, and is closely associated with the development and continued refinement of the Cochlear bionic ear. IPRI will apply specially developed intelligent polymers which have the potential for enhanced interfacing of cochlea implants with a hearing-impaired person's own neural system, greatly increasing communication benefits.

implants and biomaterials

PolyNovo Biomaterials Pty Ltd has developed a range of biocompatible and biodegradable polymers for use in medical devices. Its NovoSub compound can be used as a cement or substitute for bone tissues, as well as for periodontal reconstruction, drug delivery coatings, and as a general medical adhesive and sealant. NovoSub degrades into non-toxic products, and as its curing process generates no heat, it avoids potential damage to surrounding tissue.

AorTech Biomaterials Pty Ltd is manufacturing highly stable, highly biocompatible polymeric materials that are used in the medical device, pharmaceutical and biotechnology industries. Its Elast-Eon™ products are based on novel biocompatible polymers that can be employed in the fields of cardiovascular, interventional cardiology, cardiac rhythm management and orthopaedics. The company is embarking on a project focusing on nanoscale surface interaction properties of polymers to create bioactive surfaces that work with the body's chemistry to promote healing.

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Invest Australia is the front door to investment opportunities in Australia and has a team dedicated to helping overseas companies find investment opportunities in Australia's nanotechnology sector.

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HEAD OFFICE, CANBERRA
+61 2 6213 6711
askus@investaustralia.gov.au

SYDNEY +61 2 9397 1600
askus@investaustralia.gov.au

SAN FRANCISCO +1 415 243 2071
sanfrancisco@investaustralia.gov.au

NEW YORK +1 212 351 6570
newyork@investaustralia.gov.au

FRANKFURT +49 69 9055 8200
frankfurt@investaustralia.gov.au

LONDON +44 20 7632 0011
london@investaustralia.gov.au

PARIS +331 40 59 33 91
paris@investaustralia.gov.au

SHANGHAI +86 21 5292 8686
shanghai@investaustralia.gov.au

BEIJING +86 10 6532 2331
beijing@investaustralia.gov.au

SINGAPORE +65 6836 4109
singapore@investaustralia.gov.au

TOKYO +81 3 5232 3053
tokyo@investaustralia.gov.au

VISIT > **www.investaustralia.gov.au**

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